K means clustering

```
import pandas as pd
df = pd.read_csv('/kaggle/input/unsupervised-learning-on-country-data/Country-data.csv')
print(df.head())
```

```
               country  child_mort  exports  health  imports  income  \
0          Afghanistan        90.2     10.0    7.58     44.9    1610   
1              Albania        16.6     28.0    6.55     48.6    9930   
2              Algeria        27.3     38.4    4.17     31.4   12900   
3               Angola       119.0     62.3    2.85     42.9    5900   
4  Antigua and Barbuda        10.3     45.5    6.03     58.9   19100   

   inflation  life_expec  total_fer   gdpp  
0       9.44        56.2       5.82    553  
1       4.49        76.3       1.65   4090  
2      16.10        76.5       2.89   4460  
3      22.40        60.1       6.16   3530  
4       1.44        76.8       2.13  12200  
```

```
from sklearn.preprocessing import OneHotEncoder
```

```
ohe = OneHotEncoder(sparse=False)
```

```
country_encoded = ohe.fit_transform(df[['country']])
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/preprocessing/_encoders.py:868: FutureWarnir
  warnings.warn(
```

```
country_df = pd.DataFrame(country_encoded,columns=ohe.get_feature_names_out(['country']))
```

```
print(country_df.head())
```

```
   country_Afghanistan  country_Albania  country_Algeria  country_Angola  \
0                  1.0              0.0              0.0             0.0   
1                  0.0              1.0              0.0             0.0   
2                  0.0              0.0              1.0             0.0   
3                  0.0              0.0              0.0             1.0   
4                  0.0              0.0              0.0             0.0   

   country_Antigua and Barbuda  country_Argentina  country_Armenia  \
0                          0.0                0.0              0.0   
1                          0.0                0.0              0.0   
2                          0.0                0.0              0.0   
3                          0.0                0.0              0.0   
4                          1.0                0.0              0.0   

   country_Australia  country_Austria  country_Azerbaijan  ...  \
0                0.0              0.0                 0.0  ...   
1                0.0              0.0                 0.0  ...   
2                0.0              0.0                 0.0  ...   
3                0.0              0.0                 0.0  ...   
4                0.0              0.0                 0.0  ...   
```

```
   country_United Arab Emirates  country_United Kingdom  \
0                           0.0                     0.0   
1                           0.0                     0.0   
2                           0.0                     0.0   
3                           0.0                     0.0   
4                           0.0                     0.0   

   country_United States  country_Uruguay  country_Uzbekistan  \
0                    0.0              0.0                 0.0   
1                    0.0              0.0                 0.0   
2                    0.0              0.0                 0.0   
3                    0.0              0.0                 0.0   
4                    0.0              0.0                 0.0   

   country_Vanuatu  country_Venezuela  country_Vietnam  country_Yemen  \
0              0.0                0.0              0.0            0.0   
1              0.0                0.0              0.0            0.0   
2              0.0                0.0              0.0            0.0   
3              0.0                0.0              0.0            0.0   
4              0.0                0.0              0.0            0.0   

   country_Zambia  
0             0.0  
1             0.0  
2             0.0  
3             0.0  
4             0.0  

[5 rows x 167 columns]
```

```
print(country_df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 167 entries, 0 to 166
Columns: 167 entries, country_Afghanistan to country_Zambia
dtypes: float64(167)
memory usage: 218.0 KB
None
```

```
df = pd.concat([df.drop('country',axis=1),country_df],axis=1)
```

```
print(df.head())
```

```
   child_mort  exports  health  imports  income  inflation  life_expec  \
0        90.2     10.0    7.58     44.9    1610       9.44        56.2   
1        16.6     28.0    6.55     48.6    9930       4.49        76.3   
2        27.3     38.4    4.17     31.4   12900      16.10        76.5   
3       119.0     62.3    2.85     42.9    5900      22.40        60.1   
4        10.3     45.5    6.03     58.9   19100       1.44        76.8   

   total_fer   gdpp  country_Afghanistan  ...  country_United Arab Emirates  \
0       5.82    553                  1.0  ...                           0.0   
1       1.65   4090                  0.0  ...                           0.0   
2       2.89   4460                  0.0  ...                           0.0   
3       6.16   3530                  0.0  ...                           0.0   
4       2.13  12200                  0.0  ...                           0.0   

   country_United Kingdom  country_United States  country_Uruguay  \
0                     0.0                    0.0              0.0   
1                     0.0                    0.0              0.0   
```

```
2                     0.0                    0.0              0.0
3                     0.0                    0.0              0.0
4                     0.0                    0.0              0.0

   country_Uzbekistan  country_Vanuatu  country_Venezuela  country_Vietnam  \
0                 0.0              0.0                0.0              0.0
1                 0.0              0.0                0.0              0.0
2                 0.0              0.0                0.0              0.0
3                 0.0              0.0                0.0              0.0
4                 0.0              0.0                0.0              0.0

   country_Yemen  country_Zambia
0            0.0             0.0
1            0.0             0.0
2            0.0             0.0
3            0.0             0.0
4            0.0             0.0

[5 rows x 176 columns]
```

```
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 167 entries, 0 to 166
Columns: 176 entries, child_mort to country_Zambia
dtypes: float64(174), int64(2)
memory usage: 229.8 KB
None
```

```
print(df.shape)
```

```
(167, 176)
```

```
from sklearn.cluster import KMeans
```

```
wcss = []
for i in range(1,11):
    kmeans = KMeans(n_clusters=i, random_state=42)
    kmeans.fit(df)
    wcss.append(kmeans.inertia_)
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
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  warnings.warn(
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  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
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  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
```
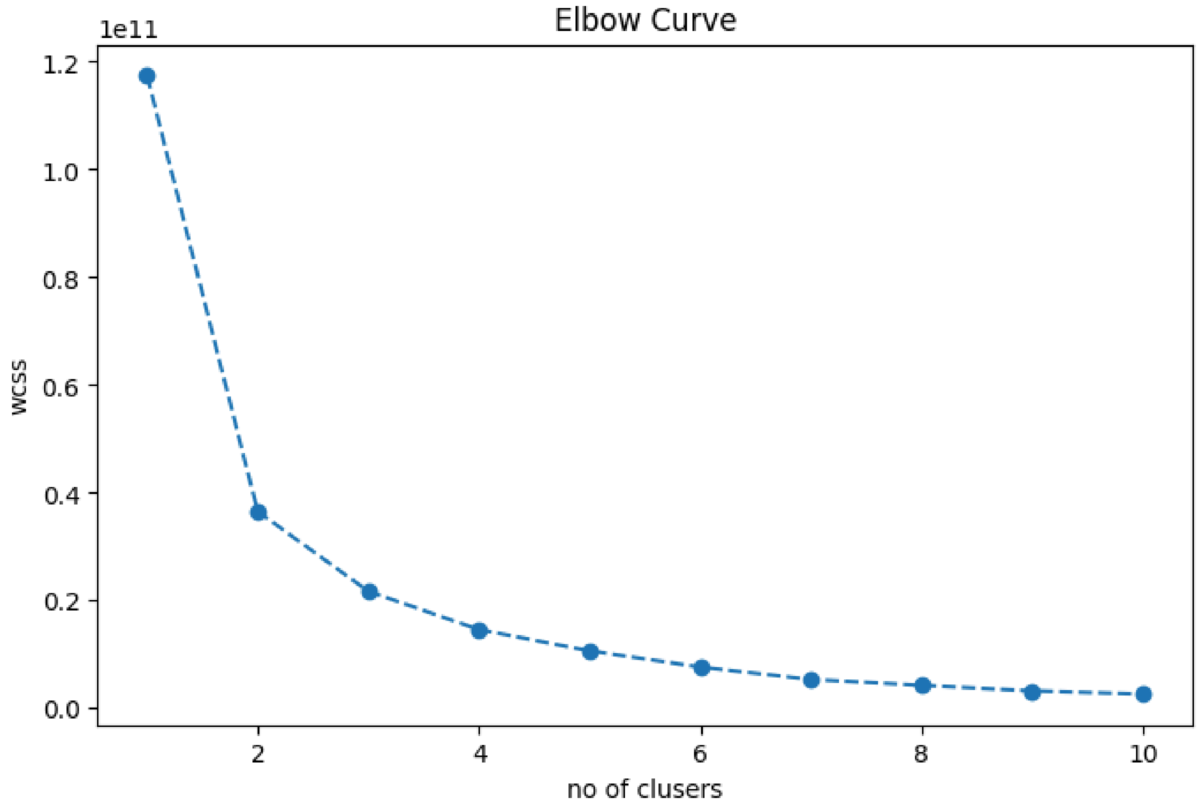

```
print(wcss)
```

```
[117459687635.07814, 36528388099.3221, 21710210203.75414, 14610713609.535135, 10655378245.86
```

```
#plot elbow curve
import matplotlib.pyplot as plt
plt.figure(figsize=(8,5))
plt.plot(range(1,11),wcss,marker='o',linestyle='--')
plt.title("Elbow Curve")
plt.xlabel("no of clusers")
plt.ylabel('wcss')
plt.show()
```



```
kmeans = KMeans(n_clusters=4,random_state=42)
y_kmeans = kmeans.fit_predict(df)
df['cluster']=y_kmeans
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The c
  warnings.warn(
```

```
print(df.head())
```

```
   child_mort  exports  health  imports  income  inflation  life_expec  \
0        90.2     10.0    7.58     44.9    1610       9.44        56.2   
1        16.6     28.0    6.55     48.6    9930       4.49        76.3   
```

```
2        27.3     38.4    4.17     31.4   12900      16.10        76.5
3       119.0     62.3    2.85     42.9    5900      22.40        60.1
4        10.3     45.5    6.03     58.9   19100       1.44        76.8

   total_fer   gdpp  country_Afghanistan  ...  country_United Kingdom  \
0       5.82    553                  1.0  ...                     0.0
1       1.65   4090                  0.0  ...                     0.0
2       2.89   4460                  0.0  ...                     0.0
3       6.16   3530                  0.0  ...                     0.0
4       2.13  12200                  0.0  ...                     0.0

   country_United States  country_Uruguay  country_Uzbekistan  \
0                    0.0              0.0                 0.0
1                    0.0              0.0                 0.0
2                    0.0              0.0                 0.0
3                    0.0              0.0                 0.0
4                    0.0              0.0                 0.0

   country_Vanuatu  country_Venezuela  country_Vietnam  country_Yemen  \
0              0.0                0.0              0.0            0.0
1              0.0                0.0              0.0            0.0
2              0.0                0.0              0.0            0.0
3              0.0                0.0              0.0            0.0
4              0.0                0.0              0.0            0.0

   country_Zambia  cluster
0             0.0        0
1             0.0        0
2             0.0        0
3             0.0        0
4             0.0        2

[5 rows x 177 columns]
```

```
labels = kmeans.labels_
```

```
from sklearn.metrics import silhouette_score

sil_score = silhouette_score(df, labels)
print(f'Silhouette Score: {sil_score}')
```

```
Silhouette Score: 0.6109297327684861
```

Agglomerative Clustering

```
print(df.head())
```

```
   child_mort  exports  health  imports  income  inflation  life_expec  \
0        90.2     10.0    7.58     44.9    1610       9.44        56.2
1        16.6     28.0    6.55     48.6    9930       4.49        76.3
2        27.3     38.4    4.17     31.4   12900      16.10        76.5
3       119.0     62.3    2.85     42.9    5900      22.40        60.1
4        10.3     45.5    6.03     58.9   19100       1.44        76.8

   total_fer   gdpp  country_Afghanistan  ...  country_United Kingdom  \
0       5.82    553                  1.0  ...                     0.0
1       1.65   4090                  0.0  ...                     0.0
2       2.89   4460                  0.0  ...                     0.0
```

```
3       6.16   3530                  0.0  ...                    0.0
4       2.13  12200                  0.0  ...                    0.0

   country_United States  country_Uruguay  country_Uzbekistan  \
0                    0.0              0.0                 0.0
1                    0.0              0.0                 0.0
2                    0.0              0.0                 0.0
3                    0.0              0.0                 0.0
4                    0.0              0.0                 0.0

   country_Vanuatu  country_Venezuela  country_Vietnam  country_Yemen  \
0              0.0                0.0              0.0            0.0
1              0.0                0.0              0.0            0.0
2              0.0                0.0              0.0            0.0
3              0.0                0.0              0.0            0.0
4              0.0                0.0              0.0            0.0

   country_Zambia  cluster
0             0.0        0
1             0.0        0
2             0.0        0
3             0.0        0
4             0.0        2

[5 rows x 177 columns]
```

```
print(df.shape)
```

```
(167, 177)
```

```
from sklearn.cluster import AgglomerativeClustering
```

```
ac = AgglomerativeClustering(n_clusters=3,affinity='euclidean',linkage='ward')
```

```
labels = ac.fit_predict(df)
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/_agglomerative.py:983: FutureWarning
  warnings.warn(
```

```
print(labels)
```

```
[2 2 2 2 1 1 2 0 0 2 1 1 2 1 2 0 2 2 2 2 2 2 1 0 2 2 2 2 2 0 2 2 2 1 2 2 2
 2 2 2 2 1 1 1 0 2 2 2 2 1 2 1 2 0 0 2 2 2 0 2 1 2 2 2 2 2 2 1 0 2 2 2 2 0
 1 0 2 0 2 1 2 2 0 2 2 1 2 2 2 1 1 0 2 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 0
 1 2 2 0 1 2 2 2 2 2 1 1 0 2 1 2 2 1 2 2 1 2 0 1 1 2 2 1 1 2 2 2 2 0 0 2 2
 2 2 2 2 2 1 2 2 2 0 0 0 1 2 2 1 2 2 2]
```

```
from sklearn.metrics import silhouette_score
```

```
print(f"silhouette_score: {silhouette_score(df,labels)}")
```

```
silhouette_score: 0.5963166843614005
```